

Design, Fabrication, Load Testing and delivery of 27 Tonne Payload
Tri axles Well bed semi trailer

Scope of Work:

- Design of Tri axle well bed semi trailer of 27T pay load capacity.
- Complete design calculations of the trailer including canopy, Shock isolation system, electrical circuit and air circuit to be submitted for IPRC approval.
- Detailed Engineering and preparation of fabrication drawings for the trailer including canopy, Shock isolation system and stage mounting fixtures.
- Fabrication, load testing of trailer and testing of canopy.
- Obtaining design approval of the trailer from MORT & H / STA and temporary registration of the trailer.
- Delivery of the trailer at IPRC, Mahendragiri.
- Commissioning of trailer at IPRC, Mahendragiri.

Description of the trailer system:

The trailer with inbuilt canopy bottom half and separable canopy top half is meant for transportation of L110, C25, PS2/GS2, CUS and SC120 stages from IPRC, Mahendragiri to SDSC, Sriharikota. This common trailer will have separate stage support fixtures with wire rope isolators as mentioned in enclosed drawing for supporting the above stages on trailer bed. The maximum envelop dimension of the L110, C25 and SC120 stages with the stage interface fixtures required to mount on support fixtures, mass and approximate CG location, General arrangement of canopy are shown from fig.1 to fig. 12. The following figures are enclosed herewith for reference.

- Fig. 1 - L110 stage with supporting details on transportation trailer
- Fig. 2 - L110 stage interface fixture (Fore end)
- Fig. 3 - L110 stage interface fixture (Aft end)
- Fig. 4 - C25 stage with supporting details on transportation trailer
- Fig. 5 - C32 stage with supporting details on transportation trailer
- Fig. 6 - C25 & C32 stage interface fixture (Fore end)
- Fig. 7 - C25 & C32 stage interface fixture (Aft end)
- Fig. 8 - Semi Cryo stage with supporting details on transportation trailer
- Fig. 9 - Semi cryo stage interface fixture (Fore end)
- Fig. 10 - Semi cryo stage interface fixture (Aft end)
- Fig. 11 - Cryo stage with supporting details on transportation trailer
- Fig. 12 - General Arrangement of canopy

A necessary support fixture with wire rope isolators for mounting on the trailer is the scope of the contractor. The trailer should be designed for a minimum payload of 27T capacity. The pay load includes the weight of:

- a) Stage (Dept. Scope)
- b) Stage interface fixtures (Dept. Scope)
- c) Stage Support fixtures (Contractor's Scope)
- d) Wire rope isolators (Contractor's Scope)
- e) Canopy bottom half (inbuilt with trailer, Contractor's Scope)
- f) Canopy top half (Contractor's Scope)

The mass of canopy bottom half and top half is assumed as 11 Tonne. If the estimated mass of the canopy is increased during detailed engineering, then the payload capacity of the trailer is to be increased accordingly. The schematic of the trailer with L110 stage, C25 stage and SC120 stage mounted on trailer is shown in respective figures. The minimum clearance required between stage and canopy wall / trailer bed is as follows:

Top	: 100 mm
Bottom	: 100 mm (isolators in maximum deflection condition)
Side	: 100 mm
Front	: 300 mm
Rear	: 300 mm

The trailer system shall consist basically air suspension system, Shock isolation system, rear wheel self steering system and canopy.

Detailed Specifications of the trailer system:

1. Capacity

1.1. Payload carrying capacity & Type:

- 27.00 T Tri Axle Well Bed Semi-Trailer.
- To be used by AL 4921 prime-mover.

1.2. Description:

- The Trailer will be used for the transportation of L110, C25, PS2/GS2, CUS and SC120 stage carrier;
- (Weights upto 13.00 T + Fixtures + Isolators + canopy Wts).

1.3. Maximum Operating speed:

- 50KM/Hr under no load.
- 40KM/Hr with full load.

2. **Weight & Dimension of the Trailer:**

2.1. Estimated Laden Weight (Pay Load) (including canopy Wt.)	:27.00T
2.2. Gross Laden Weight	: 45.00 T (Nominal)
2.3. Platform Length	: 13.80 m.
2.4. Platform height	: 800 mm
2.5. Overall width	: 5200 mm.
2.6. Overall Unladen Height	: 5300 ⁻⁵⁰ mm.
2.7. Ground Clearance (Min.)	: 450 ^{±25} mm
2.8. Overall combination length with prime-mover:	25800 mm (app.)

Note:

1. Turning circle radius (outer) to be specified.
2. In order to obtain the minimum ground clearance, instead of conventional two main beam design, multiple longitudinal beams may be used.

3. **King Pin:**

3.1. Size: 2"

3.2. IS Standard: IS 6763 part-I or equivalent.

3.3. **Rubbing Plate Height:**

- Shall be kept so that the Trailer shall be in horizontal when loaded; In unloaded condition, the height of the 5th wheel coupling top mating plate from the ground level is 1400mm (approx.) and to suit AL4921.

3.4. **Testing:**

- Shall be tested with ultrasonic test for any internal defects; only defect-free pin shall be used.

4. **Chassis Frame:**

4.1. **Trailer Structure:**

- The trailer frame shall be all welded structure.
- The **main load bearing structural members** shall be made of ST 52 or Equivalent. The other members shall be of IS 2062.
- The **Factor of Safety** shall not be less than 4 on Ultimate Strength. The deflection measured at the middle of the trailer frame shall not be more than L/350 under max load.

- The Trailer platform shall be provided with 5 mm Aluminum chequered plate.
- The platform shall be designed to withstand a uniform load of 200Kgf / sq.m.

4.2. Stabilizers (Landing legs):

- Three pairs of **Two speed landing legs** of each 25T capacity per pair shall be provided for use in loaded and un loaded condition.
- One pair at front, one pair at middle and other pair at rear supporting bed area shall be provided. Each pair is operable in tandem using a lever. The landing gears are of co-axial tubes moving inside the other. The actuation of inner tubes is through set of gears. (spur & bevel gears).
- The two legs of each pair shall be **positioned closer to extreme ends** across the width of the trailer to provide maximum stabilizing moments.
- The Landing leg shall be handy, convenient to use & operable by a single operator.

4.3. Goose Neck:

- The goose neck portion (front platform) width of 2100 minimum shall be provided.
- The goose neck shall be strong enough to keep the 5th wheel load when the pay load is kept at the rear end of the trailer.

4.4. Isolator:

Suitable helicoil wire rope isolators are to be fitted between the stage interface fixture and stage support fixture for L110, C25/C32 and SC120 stages. The sizing of the shock isolators shall be provided by the supplier. The input for sizing of isolators is as follows:

- a. The selected isolators should be able to limit the shock response to less than 5g for the pay load
- b. Design shock conditions
 - Drop from 100 mm height
 - Half sine shock: 15g 10 milli second duration

4.5. Canopy:

The canopy is to be constructed from steel frame consists of ISA Angles and Channels. The canopy is of two halves, the bottom half is integral with trailer bed. The top half is a removable piece and interfaces with bottom half. All structural

members shall be formed out of hot rolled steel sections conforming to IS 226. The whole canopy structure shall be of welded construction using CO₂ shielded arc welding process. Screwed type twist locks of min. 5 nos on each side lengthwise shall be provided on corner castings with suitable rain water sealing system for top half and bottom half interface lock. There shall be four man entry doors with hinge provision on all the corners of the bottom half. Necessary care shall be taken to ensure leak tightness. EPDM gaskets shall be provided for all door seals. The gaskets shall be of "J cum C" type as per the practice prevalent in the container industry. Standard door locking mechanisms shall be provided to have leak proof door design. Climbing ladder shall be attached at back end of the canopy. Lifting hooks shall be provided at the top of the canopy for handling. Proper reinforcement is to be done near the lifting hook areas. The top half should be strengthened in such a way that, the open bottom end should not deform while handling. The GA drawing of the canopy is given in figure 9.

4.6. Other Fittings:

- **Red reflectors** of sufficient numbers on the rear & sides.
- **Tool Box** of (800x600x400) with hinged lid & lock on the goose neck. Lock (Godrej Navtal 7 levers with 3 keys)
- Number & **STOP boards** at rear.
- Brass / copper earth chains on both sides at rear end of the platform.
- **Spare wheel mountings** for 2 wheels on the goose neck.
- A **step ladder** shall be provided at rear end of trailer.

5. Axles and rear wheel steering:

- Standard axles of adequate capacity (min. 12T) shall be provided.
Make: York / BPW/FUWA.
- First and second axle shall be rigid with Air suspension; Rear axle is self Steerable with air suspension. Control for the steering axle lock during reverse movement to be provided in the prime mover cabin along with electrical wiring. Provision for manual pneumatic locking also to be provided.
- The hubs and brake drums shall be separate for attending to break system repairs easily without removal of hub.
- Axle bearings shall be of reputed make.
- Inner wheels shall be accessed easily for attending to maintenance and tires for changing works.

- Suitable provision shall be given in the hub removal and replacing of bearing cones easily from the hub.

6. **Suspension :**

- The Trailer shall be provided with Air suspension with Telescopic shock absorbers of suitable capacity. Independent vent valve to be provided for each air spring.
- The suspension shall equalize, side to side and axle to axle for the control of braking.

7. **Brakes:**

- Twin line **air brake system** coupled with hauler brake through palm couplings and actuated from Tractor.
- All axles shall be fitted with service brakes.
- **Manual Parking brakes** with control lever on the Trailer shall be provided with failsafe brakes.
- All brake actuation system shall be provided with Automatic **slack adjuster** for adjusting of brake shoes.
- The Trailer shall be fitted with an **air reservoir** having capacity to give minimum of four brake a
- Applications with pressure drop from cut-out to cut-in pressure.
- The retarding force produced by braking system should be equal to 45% of rated load on the axle.
- An **emergency relay valve** shall be provided in the system to apply brakes automatically in case of trailer brake coupling failure.
- Brake parts, air regulator valves shall be of reputed make.
- The trailer tanks shall be provided with auto drain valve.

8. **Wheels & Tyres:**

- Standard ring type wheel drums of reputed make shall be used.
- Heavy duty pneumatic type of size 10.00 x 20- 16 PR to withstand high way operation shall be provided (if the design warranted for higher capacity wheels & tires, same may be used).
- The tires shall be of indigenous make and sizes and shall be freely available in the market.

- Long inflation necks or adopters shall be provided for accessing inner wheels for checking tyre inflation.

9. Electrical Fittings:

- All electrical accessories shall function on 24V DC supply from the Prime-mover.
- The trailer shall be provided with combination type tail lamp consisting of parking lamp, brake lamp, side indicator and number board lights.
- Trailer sides shall be provided with red light fittings with separate switch control.
- All the wiring materials shall be of reputed make and routed through PVC tubes with less number of bends and joints. All light fittings shall be weatherproof construction.
- Male and female sockets shall be provided with sufficient length of cable to connect with the hauler supply joint.
- Red reflectors shall be provided on the rear end of the trailer – 4 Nos; Reflecting surface area dia 75mm; also on the sides 5 each.

10. Painting:

- The Trailer shall be degreased, rust removed and sand blasted for preparation for painting.
- The inner surfaces of the box sections shall be cleaned and painted with Zinc epoxy primer (by brush) to a thickness of 65 microns DFT (Dry Film Thickness) before closing the section.
- Immediately after sand blasting one coat of zinc rich epoxy primer (Two components) shall be applied to a Dry film Thickness (DFT) of 65 microns. An intermediate coat of 100 microns (DFT) of high built epoxy primer has to be given. Final coat of 40 microns(DFT) of polyurethane enamel of pale cream colour paint with Black zebra stripes at the ends is to be given.
- Any intermediate cleaning required between successive coats of paint are to be carried out as per the recommendation of paint manufacturers.
- Make of paint shall be Berger, Asian, Grand poly coat, Bombay paints, Shalimer

11. Items to be supplied with Trailer:

- Self closing type palm coupling 2 sets for both trailer & hauler part.
- Wheel nut spanner and long lever – 2 Nos.
- Hub nut spanner with lever – 2 Nos.

- Spare wheel mounted with tyre and tube – 1 No.
- Maintenance manual for the trailer and suspension system – 3 sets.
- Spare wheel bolts 6 Nos & Spare wheel nuts 20Nos.
- Spare wheel bearing inner - 2 Nos
- Spare wheel bearing outer – 2 Nos
- Air spring for air suspension – 2 Nos
- Wheel oil seal : 6 Nos
- Brake lining: 4 Nos.
- Axle lock nut – 2 Nos
- Axle Lock washer – 4 Nos
- Brake chamber hoses – 4 Nos
- Documents required for Registration.

12. **Bought-out Items:**

- Bought-out items shall be of following make or equivalent.
 - Fasteners : Unbrako / TVS.
 - Bearings : SKF / FAG / Tata-Timken
 - Landing Legs/Stablizers : JOST / YORK / FUWA
 - Axles: YORK/BPW/FUWA
 - Shock isolators: ENIDINE/SOCITEC/CAVOFLEX

13. **Quality Assurance Plan: Terms & Conditions:**

13.1. **Requirements:**

- The supplier shall check & **produce certificates** at various stages during progress of work as detailed below:
- **Before Fabrication:**
 - The Supplier shall submit the design calculations of the trailer including canopy, brake & suspension systems, specifications of bought-out items / components / sizing of shock / wire rope isolators and Load reaction calculations. The design submitted by the supplier will be reviewed by a design review team of IPRC before detailed engineering. After the detailed engineering, the party shall submit all the fabrication drawings to IPRC for review and clearance. **The fabrication shall start only after the clearance of fabrication drawings from IPRC.**

- **Test certificates** from Govt approved Test Houses for chemical composition of raw materials used.
- The fabricator should submit the detailed QA plan before start of production for IPRC approval.
- **During Fabrication:**
 - All the welds shall be tested after final weld. All the welds shall be free from crack or any other defect.
 - Repair works shall be carried-out only after approval from IPRC.
- **After Fabrication:**
 - The supplier shall produce a Quality Report containing all the certificates / Documents as mentioned above.
 - The supplier shall assemble the items and show the satisfactory performance of the items at the time of inspection by IPRC before dispatch at supplier's site.
 - The thickness of paint shall be measured after painting by the supplier in the presence of IPRC and shall meet the specifications.
 - The supplier shall indicate stage-wise inspection plan and get cleared by IPRC accordingly.
 - The supplier shall do the final assembly and demonstrate the performance by carrying-out the Load Testing. Dummy Loads shall be arranged by the Supplier.

13.2. Inspection & Clearance

- Design will be cleared by IPRC before taking-up the fabrication works by the supplier.
- The Trailer along other systems will be inspected at various stages during fabrication stage.
- Final inspection will; be carried-out after completion of all works and the Trailer will be cleared for transportation. **Load Testing shall** be carried-out for evaluation of Trailer performance.

13.2.1. Stage inspection:

- The Trailer & systems will be inspected by IPRC at supplier's premises during the course of fabrication & testing to ensure that trailer is fabricated as per specifications.

13.2.2. Final Inspection:

- Final Inspection will be carried out by IPRC along with Inspection Agency at Supplier's premises.

13.2.3. Load Testing:

- The Trailer & suspension system shall be tested for 110% of the rated load for smooth operation at Supplier's premises. Necessary prime-mover & dead weights shall be arranged by the supplier. Testing procedure shall be provided by party and approved by IPRC .

13.2.4. Testing of Canopy:

- A load of 300 Kg. shall be distributed vertically over an area of 600 x 300 mm located at the weakest area of the roof of the canopy looking for any permanent deformation or abnormalities.
- The top half of the canopy shall be lifted using a main beam and wire ropes. The bottom open end should not show any deformation.
- A stream of water shall be applied to all exterior joints and seams of the canopy from a nozzle of 12.5 mm inside diameter at a pressure of about 1 bar. The nozzle shall be held at a distance of 1.5m from the canopy exterior joints and seams and the stream of water shall have a rate of travel of around 102 mm per second. No part of the canopy shall exhibit water leakage.

13.2.5. Modifications:

- For stage & Final inspection and Load Testing, the supplier shall extend all assistance to the representatives of IPRC.
- Any minor modifications or corrections brought to the notice of supplier at time of inspection by IPRC or after the load testing shall be corrected by the supplier.
- In case of any disputes, the decision of IPRC shall be the final and binding.

13.3. Design approval and temporary Registration of the Trailer:

- The supplier shall issue all the documents required for exemption from MORT&H. IPRC will furnish all the filled up documents and apply to MORT&H for exemption. The supplier should follow-up with MORT &H to get the exemption notification.
- The supplier shall also get the design approval from STA and temporary registration before delivery of the trailer.

14. Delivery Period:

Party should clearly mentioned the time schedule required for realization of the trailer in the following format

Sl. No	Activities	No of Days
1	Design of trailer	
2	Review and approval by IPRC	30 days
3	Detailed Engineering and submission of fabrication drawing	
4	Review and clearance from IPRC	15 days
5	Submission of documents to MORT & H	
6	Fabrication of trailer	
7	Testing of trailer	
8	Delivery to IPRC	
9	Commissioning at IPRC	

15. Delivery of the Trailer:

The trailer along with all its associated systems and canopy shall be delivered by the supplier from their fabrication site to IPRC, Mahendragiri.

16. Commissioning of the Trailer:

The trailer should be commissioned at IPRC, Mahendragiri within 2 weeks from the date of receipt at IPRC